CALCIUM CAUSES PROBLEMS AT INTERNATIONAL SPACE STATION

By Kavitha Bhavi (Spring 2010)

Imagine a bottle of pure, potable water that has been obtained by recycling wastewater. Would you drink it or squirm at the thought of it? This is exactly the type of water that astronauts use for their daily needs during space expeditions.

It's commonly known that the Earth's natural life support system supplies the essential conditions for human life to go on, but for astronauts living in space, these basic necessities need to be provided by artificial means. Water is the second most crucial thing, after air, that astronauts require for survival in space.

Astronauts live and work in the International Space Station, a research facility situated in the orbit of the Earth. Here, astronauts conduct many science-related experiments. Availability of resources for daily life remains restricted in the ISS due to functional and situational conditions. An astronaut living in the ISS is provided with only 4.4 gallons of water for all daily activities, as compared to the average American who needs approximately 60 gallons a day.

Since water is not readily available in space, scientists and astronauts had to find other means to get it there. Originally, it was transported from Earth to the ISS. But because of the operational costs, this method could not be maintained; therefore a water reclamation unit was installed. The unit is capable of recycling a crew member's urine and wastewater into clean, drinking water. But for this to work, astronauts on the ISS need to recapture every possible drop of water, including those that evaporate from showers, shaving, brushing and hand-washing.

But turning urine into drinkable water isn't very easy in general, and certainly not in space. The water recovery system on the space station works in a similar fashion as a water treatment plant on Earth, which purifies wastewater in a three-step process. In the first step, a filter removes particles and debris such as skin cells, hair, etc. Then, this water is made to pass through multi-filtration beds which contain chemical substances that remove organic and inorganic impurities. Finally, the catalytic oxidation reactor removes volatile organic compounds and kills bacteria and viruses. Iodine is then added for microbial control, similar to how municipal authorities add chlorine to the water we drink, and then the resultant liquid is stored for use.

However, the $250 million water recycling system was not fail-safe. It stopped working due to clogs that developed in the system, and engineers resolving the issue found that calcium was the culprit. Further investigations showed that the high concentration of calcium came from the astronauts' urine. This discovery was alarming, and scientists are trying to figure out the exact cause for the discharge of high levels of calcium. Bone loss, a consequence of living in a zero-gravity environment, is one of the speculations that scientists are considering.

The weightless environment of space is known to induce several physiological changes in astronauts, primarily concerning bone mass and calcium levels. On Earth, the human body absorbs approximately 40 to 50 percent of the daily recommended 1000mg of calcium. But in space, the absorption levels drop to 20 to 25 percent. Vitamin D levels, which are known to help the body properly use calcium, decrease in zero gravity. Astronauts are not exposed to UV rays, the primary source of vitamin D, because of the heavy shielding in the spacecrafts.